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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/796,286

03/10/2004

Jason Reid

LAIN-050

9371

20374

7590

09/19/2006

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EXAMINER

SMOOT, STEPHEN W

ART UNIT

PAPER NUMBER

2813

DATE MAILED: 09/19/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/796,286

Applicant(s)

REID ET AL.

Examiner

Stephen W. Smoot

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 10 March 2004 and 11 July 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-86 is/are pending in the application.
- 4a) Of the above claim(s) 2-30, 32, 35, 36, 38, 42-45, 48-55, 57-72 and 77-86 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1, 31, 33, 34, 37, 39-41, 46, 47, 56 and 73-76 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

This Office action is in response to application papers filed on 10 March 2004 and to applicant's election filed on 11 July 2006.

### ***Election/Restrictions***

1. Applicant's election without traverse of Group I, Species A, and Sub-Species A-6, with claims 1, 31, 33-34, 37, 39-41, 46-47, 56, 73-76 readable thereon, in the reply filed on 11 July 2006 is acknowledged.

Claims 2-30, 32, 35-36, 38, 42-45, 48-55, 57-72, 77-86 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention or to nonelected species, there being no allowable generic or linking claim.

### ***Specification***

2. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: Method of Forming Low-k Dielectrics Using a Rapid Curing Process.

3. The use of trademarks such as SILK, BLACK DIAMOND, CORAL, and ZIRKON have been noted in this application. They should be capitalized wherever they appear and be accompanied by the generic terminology.

Although the use of trademarks is permissible in patent applications, the proprietary nature of the marks should be respected and every effort made to prevent their use in any manner which might adversely affect their validity as trademarks.

4. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

### ***Claim Objections***

5. Claims 39, 46 are objected to because of the following informality:

In claim 39, line 4, change "methylpheneylvinylsilsesquioxane" to --methylphenylvinylsilsesquioxane-- to correct spelling; and

In claim 46, line 2, change "hydrogen silsequioxane" to --hydrogen silsesquioxane-- to correct spelling.

Appropriate correction is required.

***Claim Rejections - 35 USC § 112***

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claim 37, 46-47 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 37 is indefinite because the claim scope is uncertain since a trademark or trade name cannot be used properly to identify any particular material or product [see MPEP section 2173.05(u)]. Specifically, claim 37 at line 2 identifies a dielectric material that can be selected from a group that includes BLACK DIAMOND, BLACK DIAMOND II, and CORAL.

Claim 46 recites the limitation "the silsesquioxane material" in line 1. There is insufficient antecedent basis for this limitation in claim 46 because claim 34 provides antecedence for a "poly(organo)siloxane" (see line 2).

Claim 47 is rejected under 35 U.S.C. 112, second paragraph, because it depends on claim 46.

***Claim Rejections - 35 USC § 102***

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. Claims 1, 33, 39, 46 are rejected under 35 U.S.C. 102(b) as being anticipated by Chandra et al. (US 5,059,448).

As best understood, claim 46 is being interpreted as being either directly dependent on claim 1 or on claim 33.

Referring to column 4, lines 34-43 and column 5, line 52 to column 6, line 20, Chandra et al. disclose a method of coating a substrate with hydrogen silsesquioxane resin that includes heating (i.e. curing) the applied coating by a rapid thermal process (RTP) preferably at a rate that ranges from 30 to 500 degrees C per second. The silsesquioxane resin can be substituted with alkyls like methyl, aryls like phenyl, or alkenyls like vinyl. Regarding the first elastic modulus limitation of claim 1, the applied coating would inherently have an elastic modulus. Regarding the cured dielectric material having a second elastic modulus that is greater than the first elastic modulus, this feature is presumed to be inherent to the method of Chandra et al., per MPEP section 2112.01, because the coating is produced by a method that is substantially

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identical to the applicant's method as claimed in claim 1. Accordingly, a prima facie case of anticipation has been established for claims 1, 33, 39, 46 and the burden shifts to the applicant to show that their invention is not the same as the prior art of Chandra et al.

10. Claims 1, 33, 37 are rejected under 35 U.S.C. 102(b) as being anticipated by Grill et al. (US 6,030,904).

Referring to column 2, line 54 to column 3, line 33, Grill et al. disclose a method of rapid thermal annealing (i.e. curing) a low k film formed on a wafer that can be a diamond-like carbon film by ramping the deposited film to a temperature above 350 degrees C preferably at a rate that ranges from 10 to 50 degrees C per second.

Regarding the first elastic modulus limitation of claim 1, the as deposited film would inherently have an elastic modulus. Regarding the cured dielectric material having a second elastic modulus that is greater than the first elastic modulus, this feature is presumed to be inherent to the method of Grill et al., per MPEP section 2112.01, because the film is produced by a method that is substantially identical to the applicant's method as claimed in claim 1. Accordingly, a prima facie case of anticipation has been established for claims 1, 33, 37 and the burden shifts to the applicant to show that their invention is not the same as the prior art of Grill et al.

11. Claims 1, 33, 39, 46 are rejected under 35 U.S.C. 102(b) as being anticipated by Sharangpani et al. (US 6,303,524 B1).

As best understood, claim 46 is being interpreted as being either directly dependent on claim 1 or on claim 33.

Referring to column 6, line 50 to column 8, line 32, Sharangpani et al. disclose a method of coating a substrate with a low k material that can be hydrogen silsesquioxane or methyl silsesquioxane that includes curing the applied coating at an elevated temperature of about 475 degrees C using a heating rate that is greater than 20 degrees C per second. Regarding the first elastic modulus limitation of claim 1, the applied coating would inherently have an elastic modulus. Regarding the cured dielectric material having a second elastic modulus that is greater than the first elastic modulus, this feature is presumed to be inherent to the method of Sharangpani et al., per MPEP section 2112.01, because the coating is produced by a method that is substantially identical to the applicant's method as claimed in claim 1. Accordingly, a prima facie case of anticipation has been established for claims 1, 33, 39, 46 and the burden shifts to the applicant to show that their invention is not the same as the prior art of Sharangpani et al.

12. Claims 1, 31, 33-34, 39, 46, 73-75 are rejected under 35 U.S.C. 102(b) as being anticipated by Ramos et al. (US 6,372,666 B1).

As best understood, claim 46 is being interpreted as being either directly dependent on claim 1 or on claim 33.

Referring to column 4, line 34 to column 5, line 27 and column 6, line 41 to column 8, line 29, Ramos et al. disclose a method of coating a substrate with a low k



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material that can be a silsesquioxane polymer or a siloxane polymer that includes curing the applied coating above 350 degrees C for at least 5 seconds. One example for curing the dielectric coating is to place the substrate in contact with a hot plate for a time period that most preferably ranges from 1 to 1.1 minutes, which corresponds to heating the substrate more than 300 degrees C in about 60 seconds or at an average rate of more than 5 degrees per second. The silsesquioxane or siloxane can include hydrogen and may be substituted with alkyls containing 1 to 8 carbons like methyl or with aryls containing 6 to 12 carbons like phenyl (i.e. an aromatic ring structure).

Regarding the first elastic modulus limitation of claim 1, the applied coating would inherently have an elastic modulus. Regarding the cured dielectric material having a second elastic modulus that is greater than the first elastic modulus, this feature is presumed to be inherent to the method of Ramos et al., per MPEP section 2112.01, because the coating is produced by a method that is substantially identical to the applicant's method as claimed in claim 1. Accordingly, a prima facie case of anticipation has been established for claims 1, 31, 33-34, 39, 46, 73-75 and the burden shifts to the applicant to show that their invention is not the same as the prior art of Ramos et al.

### ***Claim Rejections - 35 USC § 103***

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

14. Claim 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ramos et al. (US 6,372,666 B1) as applied to claim 33 above, and further in view of Yahagi et al. (US 2003/0092854 A1).

As shown above, Ramos et al. anticipate claim 33 of the applicant's invention. However, Ramos et al. lack the further limitation to claim 33 as set forth in claim 40 of the applicant's invention, which is that the organic/inorganic polymer is an adamantyl or adamantyl derivative containing silsesquioxane. Yahagi et al. teach polyorganosilsesquioxane resins that contain adamantyl (see paragraphs [0077] and [0078]).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the silsesquioxane polymer of Ramos et al. by including adamantyl as a substituent, as taught by Yahagi et al. Yahagi et al. recognize that polyorganosilsesquioxane resins with adamantyl substituents advantageously can form a hardened film that does not crack (see paragraph [0123]).

15. Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ramos et al. (US 6,372,666 B1) as applied to claim 33 above, and further in view of Usami (US 2001/0017402 A1).

As shown above, Ramos et al. anticipate claim 33 of the applicant's invention. However, Ramos et al. lack the further limitation to claim 33 as set forth in claim 41 of the applicant's invention, which is that the organic/inorganic polymer is a perfluorinated or partially fluorinated aryl, alkyl, or aryl-alkyl containing silsesquioxane. Usami teaches that silsesquioxane films can be formed from fluorinated silsesquioxane (see paragraph [0029]).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the silsesquioxane polymer of Ramos et al. by substituting fluorinated silsesquioxane, as taught by Usami. Usami recognizes that fluorinated silsesquioxane is a low dielectric constant material that is equivalent to hydrogen silsesquioxane (HSQ) and to methyl silsesquioxane (MSQ) (see paragraph [0083]).

16. Claim 56 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ramos et al. (US 6,372,666 B1) as applied to claim 1 above, and further in view of Grill et al. (US 6,030,904).

As shown above, Ramos et al. anticipate claim 1 of the applicant's invention. Also, Ramos et al. teach that a siloxane composition can be prepared by hydrolysis and condensation of precursors and applying the composition to the substrate by spinning on in the form of a liquid dielectric layer (see column 4, line 34 to column 5, line 52), which are limitations of claim 56. However, Ramos et al. lack a further limitation to claim 1 as set forth in claim 56 of the applicant's invention, which is patterning the

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coating by selective exposure to electromagnetic radiation or electron beam prior to the curing step. Grill et al. teach that a low k dielectric layer can be patterned either before after a rapid thermal (RTA) annealing step is performed to stabilize (i.e. cure) the deposited layer (see column 4, line 37 to column 5, line 9).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Ramos et al. and Grill et al. in order to cure the siloxane coating of Ramos et al. after incorporating a step of patterning the coating, as taught by Grill et al. Grill et al. show that the curing step can be performed either before or after the step of patterning the dielectric layer to form damascene structures, trenches, or vias without producing new or unexpected results (see column 4, lines 50-58 and column 5, lines 7-9).

17. Claim 76 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ramos et al. (US 6,372,666 B1) as applied to claim 73 above, and further in view of Yamakawa et al. (US 6,518,204 B2).

As shown above, Ramos et al. anticipate claim 73 of the applicant's invention. However, Ramos et al. lack the further limitation to claim 73 as set forth in claim 76 of the applicant's invention, which is that the organic portion is selected from an alkenyl group having from 2 to 8 carbon atoms, an alkynyl group having from 2 to 8 carbon atoms, or an epoxy group. Yamakawa et al. teach that organopolysiloxanes can include alkenyl groups like vinyl, allyl, butenyl, pentenyl, or hexenyl (see column 3, lines 28-41).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the siloxane polymer of Ramos et al. by using vinyl, allyl, butenyl, pentenyl, or hexenyl as substituents, as taught by Yamakawa et al. Yamakawa et al. recognize that vinyl, allyl, butenyl, pentenyl, or hexenyl substituents function as a curing agent for siloxane (see column 3, lines 28-29).

### ***Conclusion***

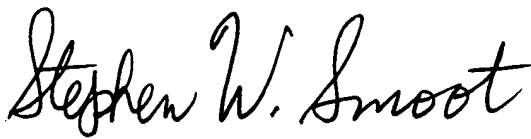
18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen W. Smoot whose telephone number is 571-272-1698. The examiner can normally be reached on M-F (8:00 am to 4:30 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

SWS

  
**STEPHEN W. SMOOT**  
**PRIMARY EXAMINER**